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MANUFACTURE OF LIQUID CRYSTAL DISPLAY ELEMENT

[Abstract]

PROBLEM TO BE SOLVED: To improve gap precision between a couple of substrates between which liquid crystal is sandwiched, uniformity in the gap surface, and alignment precision, to improve display quality, and to enable adaptation to larger sizes and narrower gaps to be required in future.

SOLUTION: One of a couple of substrates between which liquid crystal is sandwiched is coated with a sealing material for sealing the liquid crystal and the other substrate is provided with scattered spacers or projections for prescribing the cell gap. The substrate 2b is sucked to one surface plate 9 having suction holes or grooves for suction to pressure lower than the pressure in a variable pressure tank 8 between a couple of surface plates 9 and 10 put in the variable pressure tank 8 while at least one of them is freely displaced and the other substrate 2a is installed on the other surface plate 10. At this time, a two-layered structure buffer material 12 is provided between the surface plate 10 and substrate 2a. Specific pressure is produced in the variable pressure tank 8 and the substrates 2a and 2b are positioned and stucked together.

【Claims】

【Claim 1】

A method for manufacturing an LCD display device, characterized by comprising the steps of: forming seal patterns for spraying sealing materials to seal liquid crystals on one substrate of a pair of substrates interposing liquid crystals there-between; arranging spacers or providing protrusions defining cell gaps on one substrate or another substrate; and pressing and sticking the two substrates by opposing the surfaces on which the seal patterns of the pair of substrates are formed, and the surfaces on which the spacers are arranged or protrusions are formed, at an atmosphere adjusted to a predetermined pressure, and then bringing the buffer materials having a dual layer structure into contact with the outer surfaces of at least one substrate.

【Claim 2】

The method of Claim 1, wherein the method is characterized by further comprising a step for fitting the spacers, and a process for dropping or spraying liquid crystals enough to fill cell gaps on one or other substrate, in case of arranging the spacers.

【Claim 3】

The method of Claim 1 or 2, wherein the method is characterized by further comprising a step of forming abolished seal patterns unending, and enclosing the seal patterns for sealing the liquid crystals.

【Claim 4】

The method of Claim 1, 2 or 3, wherein in the step of pressing and sticking two substrates at an atmosphere adjusted to a predetermined pressure, a pair of base plates, which include suction holes or grooves, for absorbing air to form

lower pressure than the predetermined adjusted pressure are arranged, and at least one base plate is displaceable, and one substrate or another substrate is absorbed and stuck to one base plate to thereby fit and stick to one or the other substrate located on the other base plate.

【Title of Invention】 Manufacturing Method for an LCD Display Device

【Detailed Description of the Invention】

【001】

【Field of the Invention】

The present invention relates to a method for manufacturing an LCD display device, which is used for an image display device such as personal computer, television, and the like.

【002】

【Description of the Prior Art】

Conventionally, in the process of manufacturing an LCD display device, there have been an injection method and a dropping method for sealing liquid crystals into liquid crystal cells. The injection method is generally employed in the mass production, in which liquid crystals are sealed into the vacant cells through openings thereof by means of utilizing capillary action in a vacuum and pressure difference, whereas the dropping method drops the liquid crystals onto one substrate beforehand and then sticks other substrate on the one substrate in a vacuum. These methods respectively fabricate liquid crystal panels by means of utilizing process of sticking a pair of substrates.

【003】 FIG. 8 shows a flow chart of a conventional injection type process for manufacturing an LCD display device. The LCD display device 1 manufactured according to the above process has a cross-sectional structure as shown in FIG. 7. A spacer 4 is arranged to define a gap between a pair of substrates 2a, 2b provided with display electrodes 5a, 5b at their inner part, and liquid crystals 3 are sealed in the gap. Polarizing plates (not shown) or proper optical films and the like are arranged at both optimum places of the pair of substrates 2a, 2b. One

or two sheets of polarizing plates are employed depending on the principles and modes, and no polarizing plate can be employed.

【004】 The LCD display device 1 of such structure displays by radiating lights from the three wavelength type cold cathode ray tube and the like, in case of penetration type, or displays using outside lights after arranging a reflection plate at an opposite side of a display surface, in case of reflection type. The LCD display device 1 can be used as a voltage driven type display.

【005】 Further, the conventional manufacturing method for the LCD display device will be explained in connection with FIG. 8. In case of injection type, films 7 are formed through cleaning the substrates 2a, 2b provided with display electrodes 5a, 5b, and spraying liquid materials by means of offset printing and the like, and then pre-sintering and main sintering, and it is aligned by means of rubbing and the like. In general, water cleaning is carried out to remove dirty materials on the surfaces after rubbing.

【006】 Next, Sealing materials 6 are sprayed to form seal patterns by means of patterning device or screen printing and the like to thereby seal the liquid crystals 3 in the one substrate, for example, the substrate 2a. Further, UV resins for temporary fixing the panels are spot printed by means of dispensers and the like except the region of the LCD display device 1. Also, spacers 4 of predetermined size are arranged at the other substrate 2b to form gaps there-between, and both substrates 2a, 2b are stuck together at the atmosphere. The substrates 2a, 2b are stuck so that fitting mark provided on the electrodes of the substrates 2a, 2b can be optically sensed. Accordingly, the UV resins prepared for temporary fitting are hardened by radiating ultra violet rays on the condition that the fitting marks are coincided with each other.

【007】 However, the sealing materials are hardened when optimum gap is obtained, after the pair of substrates 2a, 2b are pressed by means of air press and the like, so as to control the gap of the LCD display device 1. In this instance, in case of employing heat hardening type sealing materials, the sealing materials 6 are hardened by means of the heater arranged inside of the base plate of the air press (not shown). In case of UV hardening type sealing materials, transparent thick materials such as glass or acryl material and the like are employed as base plates for air press, thereby hardening the sealing materials 6 by radiating ultra violet rays from outside of the base plates when optimum gap has been achieved.

【008】 Then, the glass portion is cut except the substrate display area, and in case of the injection type, vacant cells resulted from above process, and cells pooled with liquid crystals 3 are charged into a vacuum chamber, and the vacant cells are filled with liquid crystals 3 through contacting the injection opening with the liquid crystals and communicating the vacuum chamber to the atmosphere at a pressure range of 0.2 ~ 0.7 Torr. In addition, the injection opening is closed with resins and the like, after cleaning the liquid crystals 3 stuck to the LCD display device 1, the whole LCD display device 1 is annealed to thereby be aligned again.

【009】

【Problems to be solved by the Invention】

However, according to the conventional manufacturing method for an LCD display device 1, it is impossible to obtain sufficient high precious alignment or inner uniformity of the gap surface despite the heating press or UV press have been employed to obtain optimum gaps in case of manufacturing vacant cells. It is necessary to realize such high precision of the substrate in the way of getting larger in size of the substrate.

【0010】 That is, in the sticking type manufacturing method of the conventional LCD display device, several problems have been produced in making the alignment and gap precision optimum.

【0011】 First, the alignment process and the pressing process for making the gaps have been separated and proper vacant cells have not yet formed. Accordingly, the temporary UV resins fitted at the process of alignment process have been separated by means of the compulsory power of the pressurized press in the next process, to result in mismatch of the range of the alignment precision of the markers on the pair of the substrates to make it impossible to assemble them sufficiently.

【0012】 Further, although the pair of substrates have been temporary stuck at a high alignment precision, because the sealing materials have been heat hardening type resins in the seal hardening process, the alignment position have been differed to make it impossible to provide proper assembling precision due to the difference of the linear expansion coefficient of the pair of substrates made of glass and the sealing materials arranged between them, based on the temperature change arising from the LCD display device and the time of heating press. This becomes to be highly troublesome, as the size of the substrates is getting larger.

【0013】 While, in case of the UV resins employed to the sealing materials, ultra violet rays are radiated from outside of the transparent base plates after gaps have been once formed by the pressurized press, the base plates will be heated by the radiant heat produced from the ultra violet rays radiation as the working sheets increase, to thereby increase the temperature of the base plate itself, and as the temperature of the other substrate has not changed, temperature

differences are produced between the pair of substrates. Therefore, if the sealing materials between the substrates are hardened through the ultra violet ray radiation, the fitted substrates will be bent to form un-uniformity of the gap in the LCD display device. This becomes serious as the size of the substrates becomes larger.

【0014】 As stated above, in the conventional manufacturing method, it is impossible to cope with the substrate size, which is getting larger, in matching the sufficient alignment precision with the gap precision.

【0015】 The present invention has been developed to overcome above explained problems arising in the conventional arts, as the size of the substrate is getting larger, wherein the substrate includes the LCD display device and the like corresponding to 20 types required from the LCD monitor replacing CRTs, and the object of the present invention is to provide a method for manufacturing an LCD display device, which enables to display with high quality by improving high gap precision or the uniformity in the gap surfaces, and to realize a big and bright display device having a big opening ratio, by improving the alignment precision of the substrates.

【0016】

【Means for Solving the Problem】

To achieve the above object of the present invention, there is provided a method for manufacturing an LCD display device, characterized by comprising the steps of: forming seal patterns for spraying sealing materials to seal liquid crystals on one substrate of a pair of substrates interposing liquid crystals therebetween; arranging spacers or providing protrusions defining cell gaps on one substrate or other substrate; and pressing and sticking the two substrates by

opposing the surfaces on which the seal patterns of the pair of substrates are formed, and the surfaces on which the spacers are arranged or protrusions are formed, at an atmosphere adjusted to a predetermined pressure, and then bringing the buffer materials having a dual layer structure into contact with the outer surfaces of at least one substrates.

【0017】 In addition, in case of arranging the spacers, the method is characterized by further comprising a step for fitting the spacers, and a process for dropping or spraying liquid crystals enough to fill cell gaps on one or other substrate.

【0018】 Also, the method is characterized by further comprising a step of forming abolished seal patterns unending, and enclosing the seal patterns for sealing the liquid crystals.

【0019】 Further, in the step of pressing and sticking two substrates at an atmosphere adjusted to a predetermined pressure, a pair of base plates are arranged, which include suction holes or grooves, for absorbing air to form lower pressure than the predetermined adjusted pressure, and at least one base plate is displaceable, and one substrate or other substrate is absorbed and stuck to one base plate to thereby fit and stick to one or other substrate located on the other base plate.

【0020】 According to the present manufacturing method, since the alignment step and the gap controlling step can be performed in sequence under an atmosphere adjusted to a predetermined pressure, it is possible to improve the alignment precision degree and uniformity of the gap surface, and the uniformity of the gaps can be made more definite as the abolished seal patterns are formed.

【Embodiment of the Invention】

【0021】 Hereinafter, embodiments of the present invention are explained in detail with reference to the accompanying drawings.

【0022】 (Embodiment 1)

FIG. 1 shows a cross-sectional structure of an LCD display device manufactured according to the method of embodiment 1 of the present invention. A spacer 4 is arranged to form certain gaps between a pair of substrates 2a, 2b equipped with display electrodes 5a, 5b therein, and liquid crystals 3 are filled in the gaps. A polarizing plate (not shown) or any optical film is arranged at optimum place of both sides of the pair of substrates 2a, 2b. The substrates 2a, 2b are comprised of a color filter substrate, an array substrate with an active element arranged, and a substrate with transparent electrode and the like.

【0023】 In addition, the spacer 4 is made of one selected from a resin group including a benzoguanamin and the like or is made to be spherical shape, and stick shape fabricated from SiO2, or the spacer 4 is fixed to the substrates 2a, 2b to improve the uniformity of the gap. Sealing materials 6 are also sprayed around the periphery of the LCD display device 1. The sealing materials 6 include heat hardening type made of epoxy resins, ultra violet rays hardening type including radical type or cartion type and the like.

【0024】 Next, the method for manufacturing an LCD display device 1 using injection method is explained below with reference to a flowchart shown in FIG. 2. Liquid phase alignment material is offset printed to a cleaned substrates 2a, 2b, and then dried at high temperature to thereby form a alignment film 7. Then, a surface of the alignment film on the substrate is rubbing treated by means of the buffer, and it is cleaned in case of residual dirty materials. Sealing materials 6 are sprayed on the any one substrate, for instance the substrate 2b of the completed

substrates, by means of patterning or printing to define seal patterns, and the spacer 4 is sprayed uniformly on the substrate 2a or on the other substrate 2b. Also, a conductive resin is dispersed in spot by means of a dispenser.

【0025】 FIG. 3 is a schematic diagram showing a substrate sticking apparatus for carrying out the method for manufacturing the LCD display device of the present invention, in which conductive resins are sprayed on the substrates 2a, 2b, and then the substrates 2a, 2b are loaded and stuck. The apparatus includes at least one pair of upper and lower base plates 9, 10 in a pressure changeable chamber 8, in which any one base plate is displaceable, and a sensing camera is arranged inside of the apparatus to produce alignment.

【0026】 Firstly, any one substrate, for example, the substrate 2a is provided to the lower base plate 10 via a buffer means including two layer structural buffer materials 12, and the other substrate 2b is absorbed to the upper base plate 9 having absorption holes or grooves, and the pressure changeable chamber 8 is adjusted to be a predetermined pressure, and then the upper and lower substrates 2a, 2b are fitted to a desired precision with confirming the match of the marker, further, the upper and lower base plate 9, 10 are pressurized to stick both substrates 2a, 2b to each other, and the pressure changeable chamber 8 is returned to atmospheric pressure. In this instance, the buffer material 12 of the two-layer structure comprises a soft portion (a) absorbing thickness difference or bending of both substrates 2a, 2b, and plainness of the upper and lower base plates 9, 10, and a strong body portion (b) returning the repulsion forces with regard to any optional point of the substrate 2b so that it is possible to form uniform gap between the substrates. Then, the sealing materials dispersed

between the substrates 2a, 2b are hardened or temporary hardened to make the LCD display device 1.

【0027】 In order to form vacant cells, the periphery of the substrates 2a, 2b is sheared, and then vacant cells and liquid crystals reserving portion are prepared, and pressure in the chamber is stabilized at some degree, and then the pressure in the chamber is returned to atmospheric pressure by immersing the opening of the vacant cells into the reserving portion of the liquid crystals, and then liquid crystals 3 are injected into the cell gaps utilizing capillary action and the pressure difference formed between the inner and outer portions of the vacant cells. If the amount of the liquid crystals reaches to a desired level, the opening of the seal is closed by the resins, and then remaining liquid crystals 3 are cleaned, also the whole LCD display device 1 is annealed to align the liquid crystals 3 again.

【0028】 It is in general to form patterns with sealing materials according to the present invention to treat by patterning by means of a dispenser or printing using screen plate. The seal patterns shown in FIG. 4 is usually employed, in which abolished sealing material 11 is formed outside of the sealing material for sealing liquid crystals, and is employed to achieve gap uniformity. According to the present invention, as the substrates are stuck in the pressure changeable chamber to provide more uniform seal patterns, and the abolished sealing materials 11 shown in FIG. 4 are made to enclose the LCD display device 1, the vacant cells are maintained at low pressure level and it is possible to improve uniformity in the gap surface even if the pressure changeable chamber 8 of the assembling apparatus is returned to atmospheric pressure from the low pressure state. The vacant cells are maintained to be low pressure state till the substrates are cut to fabricate vacant cells by hardening the sealing materials mainly.

【0029】 (Embodiment 2)

The FIG. 5 shows a flowchart indicating the manufacturing method of the LCD display device according to second embodiment of the present invention. The sequence till the substrates 2a, 2b equipped with film 7 is rubbing treated, is identical to the injection method shown in FIG. 2, and if other materials are remained in the surface, cleaning process is performed after rubbing treatment.

【0030】 In this manner, the sealing materials 6 are sprayed on one substrate 2a of the finished substrates through patterning or screen printing, and the spacers 4 are dispersed uniformly on the other substrate 2b. The sealing materials 6 include UV resins of a radical or a carton type. Further, fixing type spacers 4 are employed, and it is required to have contact strength with regard to the substrate 2b at some range. Then, the conductive resins are dispersed in spot with the dispenser.

【0031】 At next step, however, it is proper to load the liquid crystals 3 on the substrate 2a in which the sealing materials are sprayed. The amount of the liquid crystals 3 loaded can be calculated beforehand by the area of the display region of the LCD display device and the gap thickness formed in the substrates. Therefore, the pattern is prepared to disperse the liquid crystals 3 uniformly to result in loading of the accomplished liquid crystals 3.

【0032】 Then, both substrates 2a, 2b are stuck by employing the assembling apparatus of the present invention. As shown in FIG. 3, the apparatus includes a pair of upper and lower base plates 9, 10 in the pressure changeable chamber 8, wherein at least one base plate is displaceable, and a sensing camera mounted in the press device so that it can be aligned, wherein the substrate 2a on which the liquid crystals 3 is dropped, is arranged on the lower base plate 10, and the

substrate 2b is attached on the upper base plate 9, then the pressure of the pressure changeable chamber 8 is adjusted to be desired pressure, the upper and lower base plates 9, 10 are pressed to attach both substrates 2a, 2b to be joined, with confirming the match of the marker's position so that the upper and lower substrates 2a, 2b can achieve desired fitting precision degree, thereby returning the pressure of the pressure changeable chamber 8 to be atmospheric pressure. Then, the sealing materials is hardened by radiating ultra violet rays only on the sealing materials 6 between the substrates 2a, 2b. For this purpose, there are masking in the display area or laser light radiation and the like. Finally, the realignment of the liquid crystals 3 is performed by way of annealing process, and then the substrates 2a, 2b are cut to fabricate the LCD display device 1.

【0033】 Further, according to the dropping method, when the abolished sealing materials 11 are formed to enclose the LCD display device 1, it is possible to increase the uniformity of the gap in central portion of the LCD display device 1 and the peripheral portion of the sealing materials 6. FIG. 6 illustrates the seal pattern thereof.

【0034】 As stated above, in the preferred embodiment of the present invention, although the device has been explained in connection with dispersing spacers, which define cell gaps, the LCD display device of the present invention can be made, for instance, through spraying photo-sensitive resins and forming patterns of the protrusions by applying photolithography technology, or forming the protrusions by printing on the resins.

【0035】

【Effect of the Invention】

As explained above, according to the new manufacturing method of the present invention, the uniformity in the gap of the LCD display device, the precision degree of the gap, and the precision degree of the alignment can be increased to make it possible to fabricate the high quality LCD display device. According to the present invention, the alignment process and the gap controlling process are not separated as were the conventional processes, but these processes are performed in one same continuous process to thereby remove problems arising secondly. Therefore, the mismatch or the discord of the alignment by forming the gaps can be prevented, and the bent of the LCD display device can be prevented to thereby enhance the mass productivity.

【0036】 Whereas, as the attaching process or the dropping process of the predetermined amount of the liquid crystals are performed in the pressure changeable chamber, it is possible to achieve higher gap precision degree to thereby realize larger size and narrower gap, which are required in advance.

【0037】 Also, the dropping method of the liquid crystals is proper to construct effective lines for tact, lead time, and can advantageously minimize the amounts of liquid crystals used and the like.

【Description of Drawings】

FIG.1 is a cross-sectional view of the LCD display device manufactured by the preferred embodiment 1 of the present invention.

FIG. 2 is a flowchart showing the method for manufacturing the LCD display device according to the preferred embodiment 1 of the present invention.

FIG. 3 is a schematic diagram showing an attaching apparatus of the substrate according to the preferred embodiment of the present invention.

FIG.4 is a view showing seal patterns according to the embodiment 1 of the present invention.

FIG.5 is a flowchart showing the manufacturing method according to embodiment 2 of the present invention.

FIG.6 is a view showing seal patterns according to embodiment 2 of the present invention.

FIG.7 is a cross sectional view showing an LCD display device manufactured by the conventional method.

FIG.8 is a flowchart showing conventional method for manufacturing an LCD display device.

【Explanation of Numerals】

1: LCD display device 2a, 2b: substrates

3: liquid crystals 4: spacer

5a, 5b: display electrodes 6: sealing materials

7: alignment film 8: pressure changeable chamber

9, 10: base plates 11: abolished sealing materials

12: dual layer structure buffer materials